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| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/714,807  | 11/18/2003  | Fwu-Juan Hshieh      | GS 133 D1           | 4534             |
| 27774   | 7590        | 08/25/2004           | EXAMINER            |                  |
| MAYER, FORTKORT & WILLIAMS, PC<br>251 NORTH AVENUE WEST<br>2ND FLOOR<br>WESTFIELD, NJ 07090 |             |                      | THOMAS, TONIAE M    |                  |
|   |             | ART UNIT             | PAPER NUMBER        |                  |
|   |             |                      | 2822                |                  |

DATE MAILED: 08/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                        |                     |
|------------------------------|------------------------|---------------------|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |
|                              | 10/714,807             | HSHIEH ET AL.       |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |
|                              | Toniae M. Thomas       | 2822                |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 18 November 2003.
- 2a) This action is **FINAL**.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 13-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) \_\_\_\_\_ is/are rejected.
- 7) Claim(s) 24 is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 18 November 2003 is/are: a) accepted or b) objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All    b) Some \* c) None of:
1. Certified copies of the priority documents have been received.
  2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | Paper No(s)/Mail Date. _____.   |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>11/18/03</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
|   | 6) <input type="checkbox"/> Other: _____.                                   |

### **DETAILED ACTION**

1. This action is a first Office action on the merits of Application Serial No. 10/714,807, which is a divisional of Application Serial No. 09/862,541 now US 6,657,256 B2. Currently, claims 13-25 are pending.

#### ***Specification***

2. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

#### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 13-25 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for forming a body region 116 by implantation and diffusion, as disclosed in fig. 3 and par. 20, lines 4-7, does not reasonably provide enablement for depositing a body region on the substrate, as recited in claim 13, line 4). The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. Applicant's disclosure clearly shows that body region 116 is formed by

implantation and diffusion, and not by deposition (fig. 3 and par. 20, lines 4-7). Furthermore, claims 13-25 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for forming a trench extending through the body region 116, as disclosed in fig. 4 and par. 21, does not reasonably provide enablement for forming at least one trench through the body region and the substrate. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. Applicant's disclosure clearly shows that trench 124 is formed through the body region and the N doped epitaxial layer 104. The trench does not extend through the N+ layer 100, which Applicant refers to as "the substrate" (par. 21, lines 1-3).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. *Claims 13-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Williams et al. (6,413,822 B2) in view of Wolf et al. (Silicon Processing for the VLSI Era – Vol. 1: Process Technology).*

The Williams et al. patent (Williams) discloses a method of making a trench DMOS transistor having overvoltage protection (figs. 23, 24A-24Q and

accompanying text). The method comprises the steps of: providing a substrate 267, 300 of a first conductivity type (fig. 23);<sup>1</sup> forming a body region P<sub>B</sub> having a second conductivity type on the substrate (figs. 24H, 24I, and col. 23, lines 35-59), forming at least one trench extending through the body region P<sub>B</sub> and the substrate 267 (fig. 24H); depositing an insulating layer 266 that lines the trench and overlies the body region (fig. 24F and col. 22, lines 45-53); depositing a conductive electrode 322 in the trench overlying the insulating layer (fig. 24F and col. 22, lines 54-61); implanting a dopant of the first conductivity type to form a source region (302) in the body region adjacent to the trench (fig. 24N and col. 27, lines 6-8); depositing an undoped polysilicon layer 278 overlying a portion of the insulating layer (Fig. 24I and col. 25, lines 42-46); and implanting a dopant of the first conductivity type to form a plurality of cathode regions in the undoped polysilicon layer (fig. 24N and col. 27, lines 6-8), the plurality of cathode regions being separated by at least one anode region.

The implanting steps for forming the source region and the plurality of cathode regions are performed simultaneously (fig. 24N and col. 27, lines 6-8).

A photolithographic mask 330 is defined over the body region and the undoped polysilicon layer 278 (fig. 24J and col. 25, line 51 – col. 26, line 8).

The step of depositing the undoped polysilicon layer 278 is performed before the implanting step (fig. 24I).

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<sup>1</sup> The substrate includes the N+ doped bulk substrate 300 and the N doped epitaxial layer 267.

The conductive electrode 322 is etched to expose a portion of the insulating layer 274 overlying the body region (fig. 24G and col. 22, lines 62-67).

A portion of the undoped polysilicon layer 278 overlying the body region and at least one trench is etched away (fig. 24K and col. 26, lines 10-16).

The insulating layer 266 is an oxide layer (col. 22, lines 45-53).

The conductive electrode 322 is polysilicon (col. 22, lines 54-61).

A drain electrode 265 is formed on a bottom surface of the substrate (fig. 24B and col. 20, lines 55-63).

A source electrode 263 is coupled to the source region 302 (fig. 23).

The oxide layer 266 has a thickness between about 500 and 800 angstroms (col. 23, Table 4).

Boron is implanted into at least the plurality of cathode regions and the anode to achieve a prescribed diode breakdown voltage (fig. 24O and col. 27, line 44 – col. 28, line 4).

Whereas Williams discloses forming a body region  $P_B$  having a second conductivity type on the substrate using an ion implantation method (figs. 24H, 24I, and col. 23, lines 35-59), Williams does not teach depositing the body region on the substrate.

The Wolf et al. reference (Wolf) forming devices in an epitaxial layer deposited on a substrate (page 124, 3<sup>rd</sup> par., lines 6-12).

One having ordinary skill in the art would have been motivated to modify Williams in view of Wolf by depositing the body region on the substrate, since the doping concentration of the device can be accurately controlled.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (571) 272-1846. The examiner can normally be reached on Monday-Thursday from 8:30 a.m. to 5:30 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MWJ

23 August 2004



Mary Wilczewski  
Primary Examiner